The Use of AMSR-E in the JMA NWP

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  - MWR data utilization status
- 2. Impacts of AMSR-E in JMA's Models
  - Impacts to the water vapor field
- 3. Verification of the model with AMSR-E
  - TCPW(Total Column Precipitable Water), Rain, CLW(Cloud Liquid Water)

1. JMA NWP MODELS

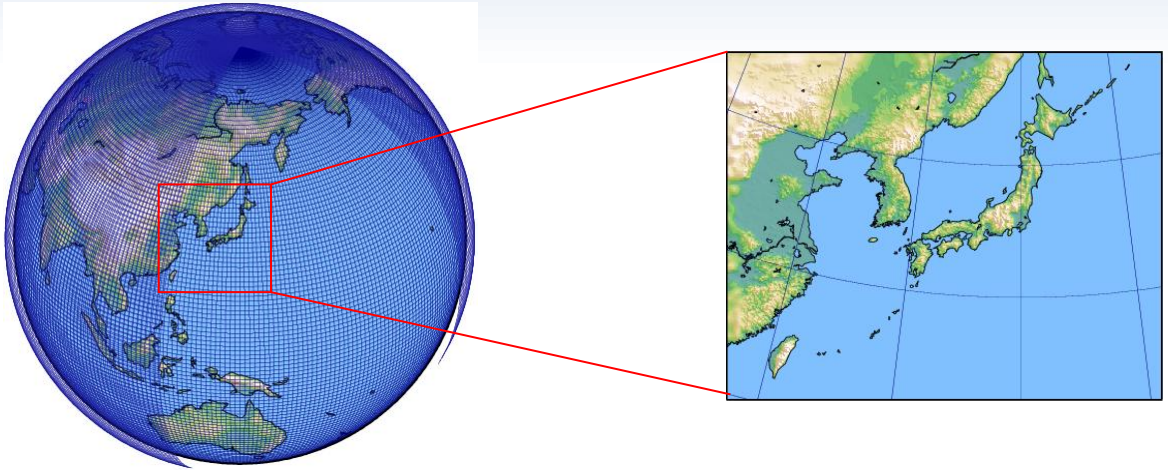
JMA's Operational Models

MWR data utilization status

MWR radiance assimilation

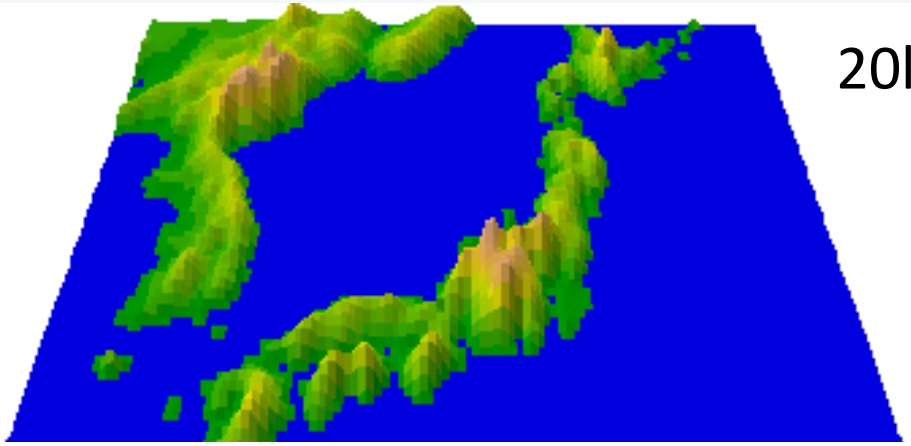
MWR data usage for GSM

JMA's Operational Models

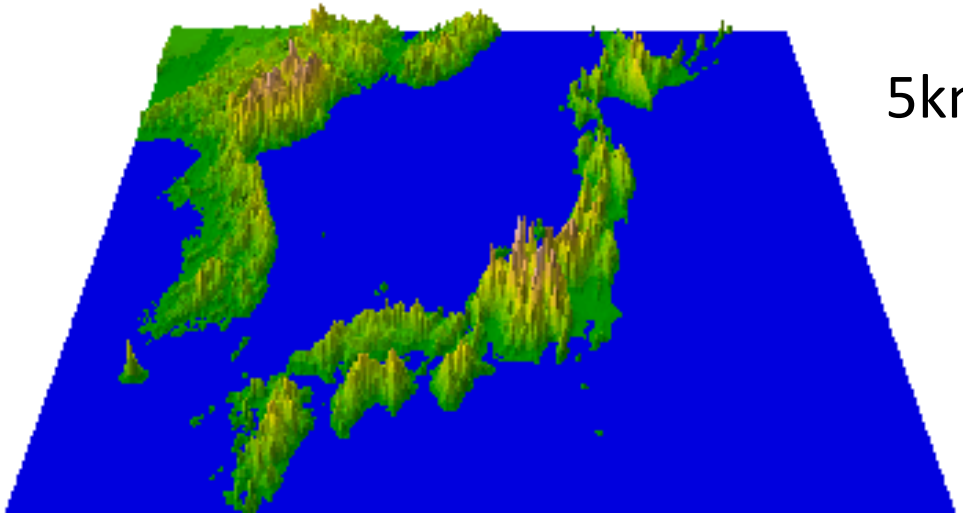


Model	**Global Spectral Model (GSM)**	**MesoScale Model (MSM)**
Resolution H/V(top height)	**TL959 (20km) / 60 (0.1hPa)**	**5km / 50 (21.8km)**
Forecast range (Initial time)	**84**h (00,06,18UTC) **216**h (12UTC)	**15**h (00,06,12,18UTC) **33**h (03,09,15,21UTC)
Target	**1 to 7 day forecast** **Aeronautical forecast**	**Disaster prevention information**
Data Assimilation (outer/inner loop)	4D-Var (TL959/T159 or 20km/80km)	4D-Var (5km / 15km)

Land resolution images



20km-GSM



5km-MSM

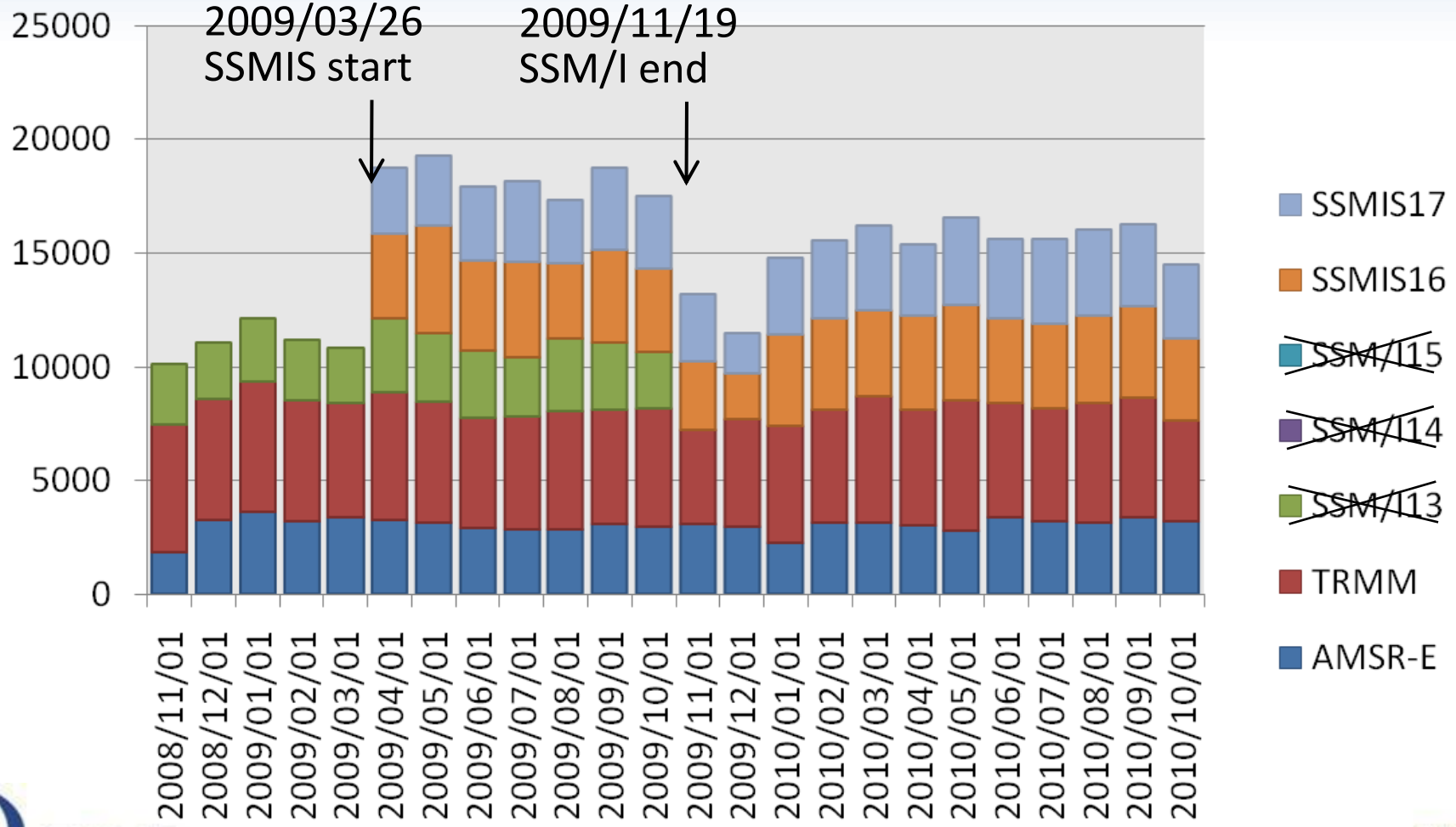
MWR data utilization status

- For MSM
  - SSM/I and TMI TCPW and Rain from Oct 2003
  - AMSR-E TCPW and Rain from Nov 2004
    - over ocean
    - rain area – precipitation
    - clear or thin-cloud areas – TCPW
    - thick-cloud area – Not used
- For GSM
  - SSM/I, TMI and AMSR-E Radiance from May 2006
  - SSMIS Radiance from Mar 2009
    - over ocean, clear sky area – vertically polarized radiances

MWR radiance assimilation

- Configurations for GSM
  - Using vertical polarized channels only
    - SSM/I: 19V, 22V, 37V, 85V
    - SSMIS: 19V, 22V, 37V, 92V
    - TMI: 19V, 21V, 37V, 85V
    - AMSR-E: 18V, 23V, 36V, 89V
  - Over clear sky ocean with SST > 5deg.C
  - Thinned by 200km box for every time slots
  - Observation Error Settings: 4σ (σ:STD)
  - Variational Bias Correction
    - Bias correction coefficients are updated in the each analysis
    - Predictors: TCPW, CLW, T_{SRF}, T_{SRF}^2, WS_{SRF}, Constant

MWR data usage for GSM



2. IMPACTS OF AMSR-E IN JMA MODELS

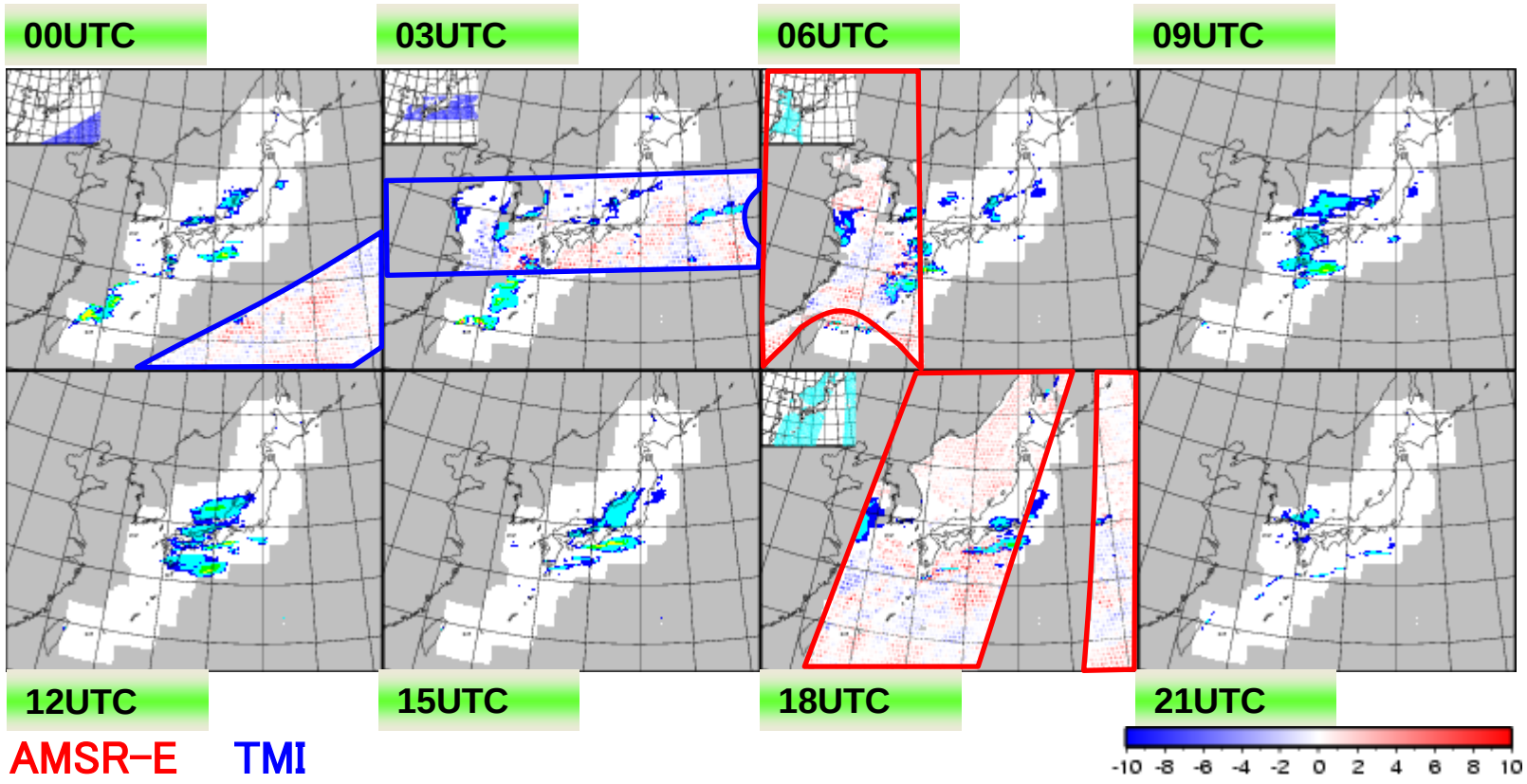
Impacts of MWR in MSM

Improvement of forecast with AMSR-E

Impacts of MWR in MSM

Rain rate & TCPW (Obs−Fisrt guess)

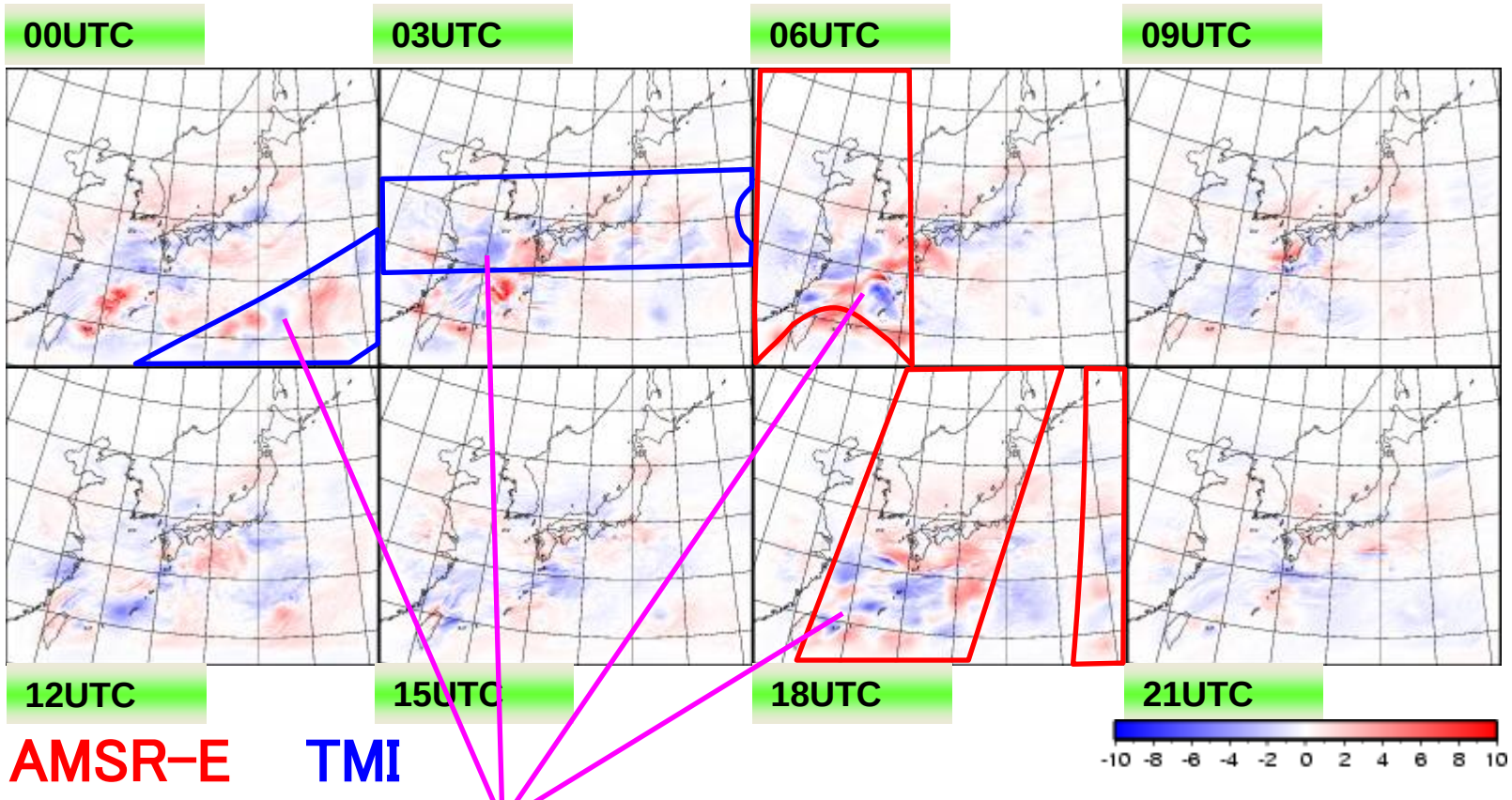
（10 Feb 2010）



Impacts of MWR in MSM

TCPW increment (Anl−Fisrt guess)

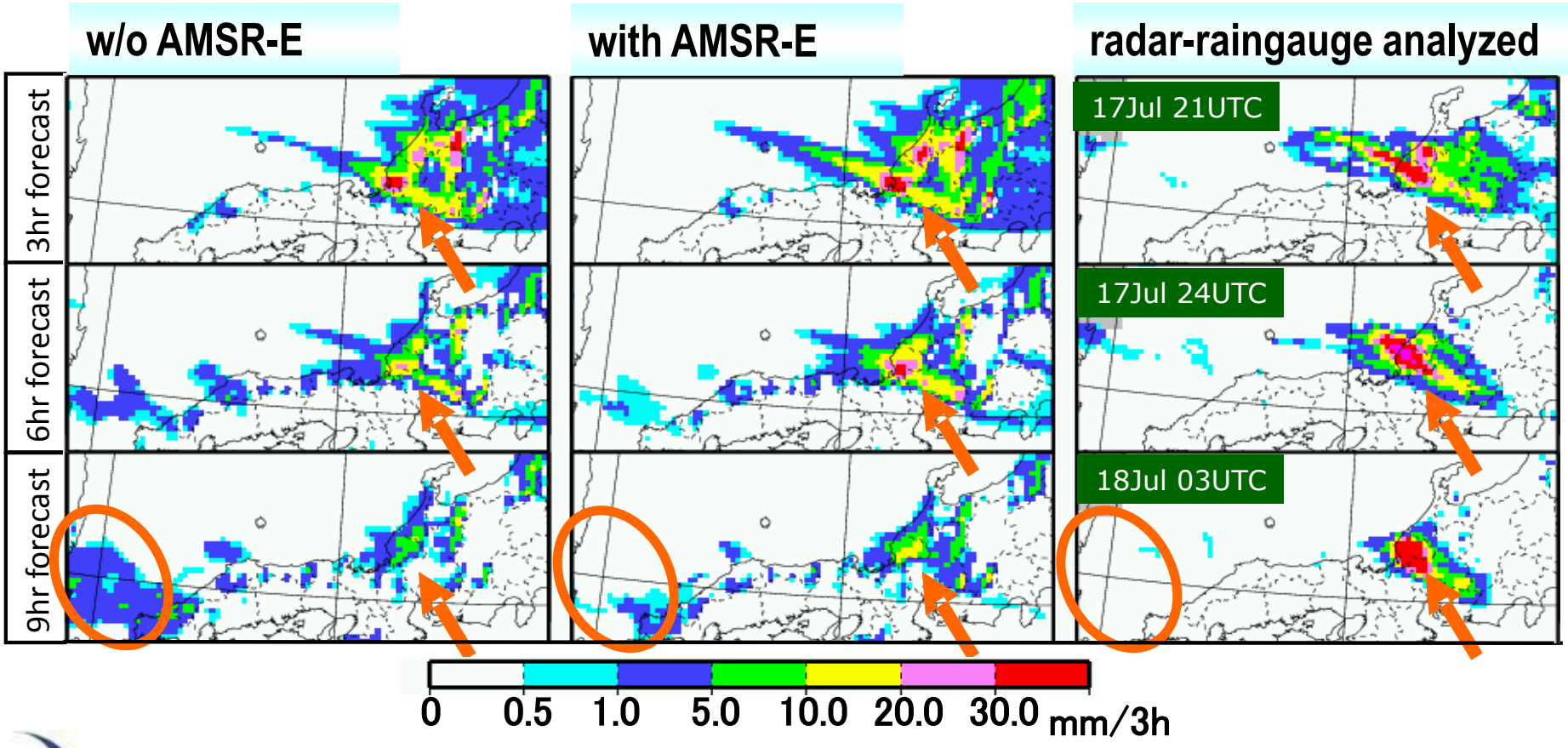
（10 Feb 2010）

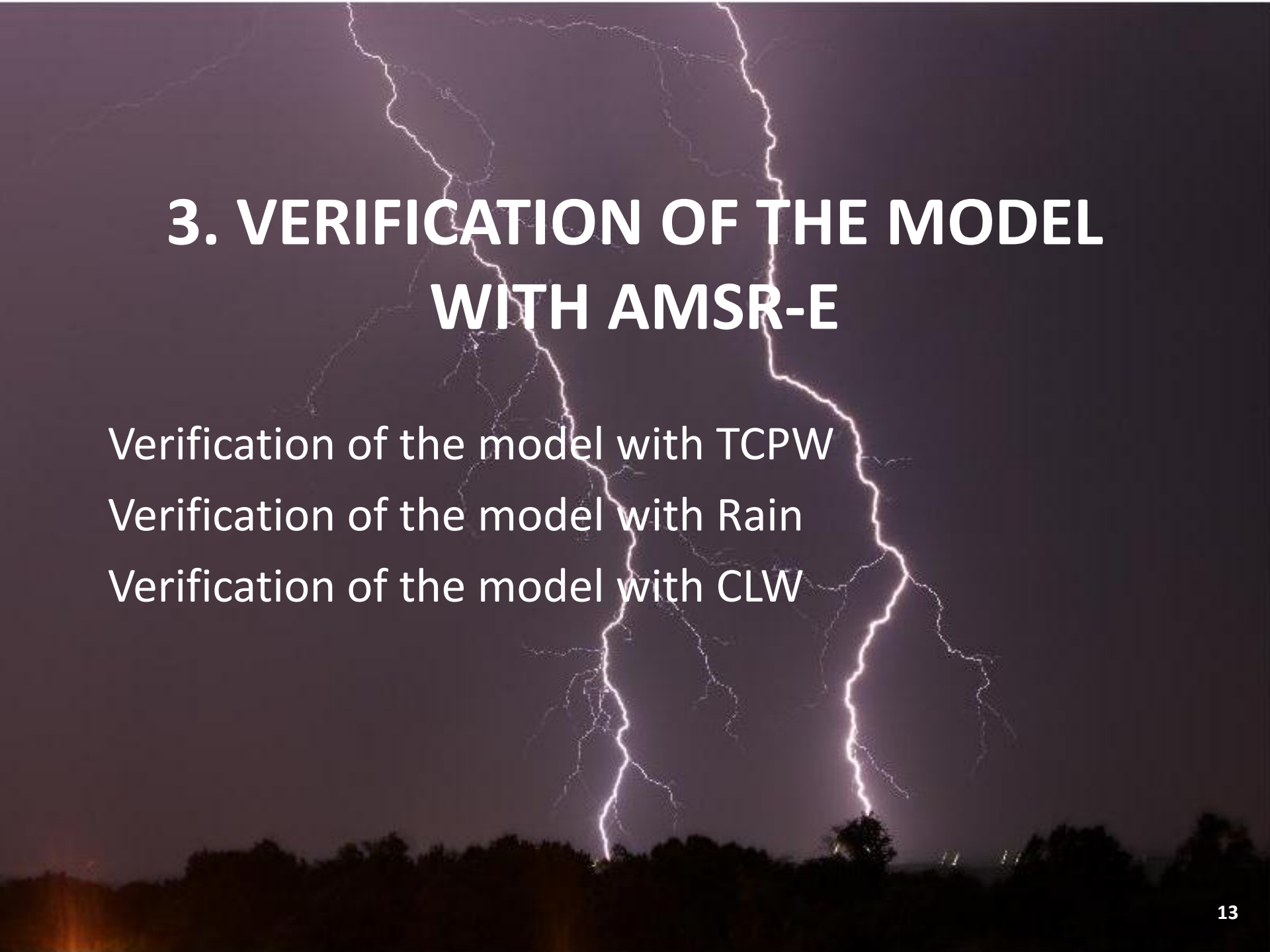


Large increment of TCPW in MW assimilated area

Improvement of forecast with AMSR-E

Fukui Heavy Rainfall in July 2004





3. VERIFICATION OF THE MODEL WITH AMSR-E

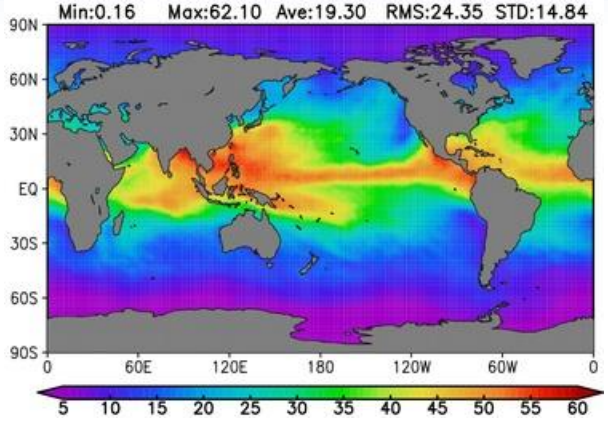
Verification of the model with TCPW

Verification of the model with Rain

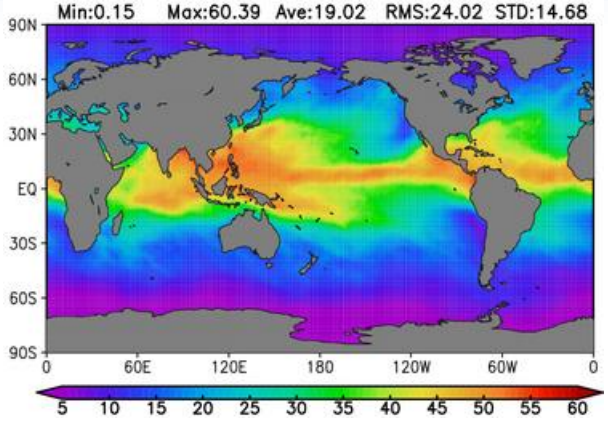
Verification of the model with CLW

Verification of the model : TCPW

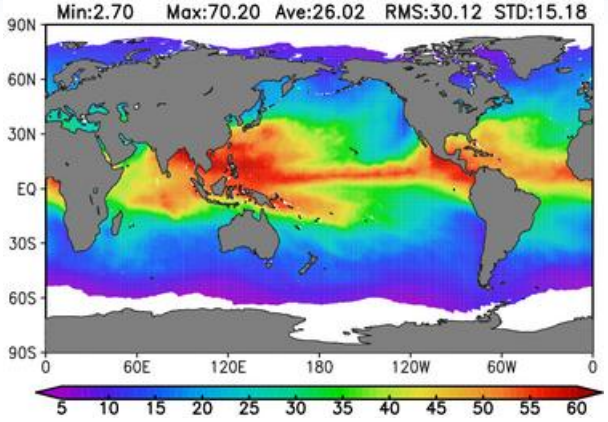
TCPW initial



3-day forecast

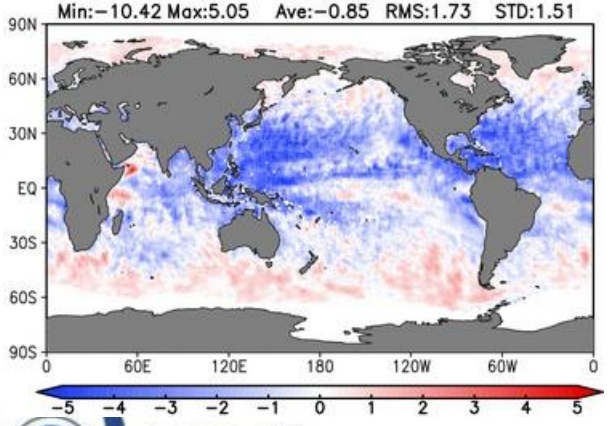


AMSR-E (by RSS)

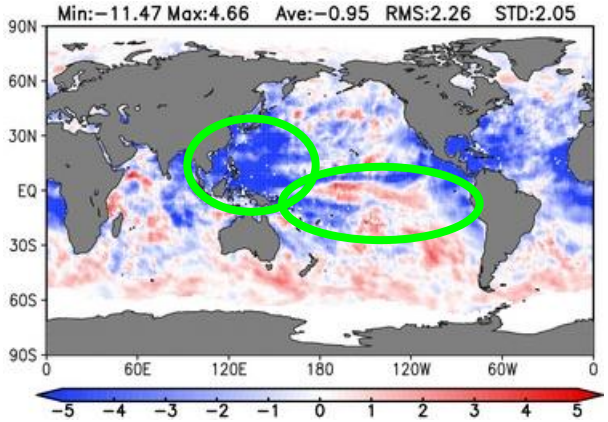


(Sep 2008, monthly ave)

initial−AMSR-E



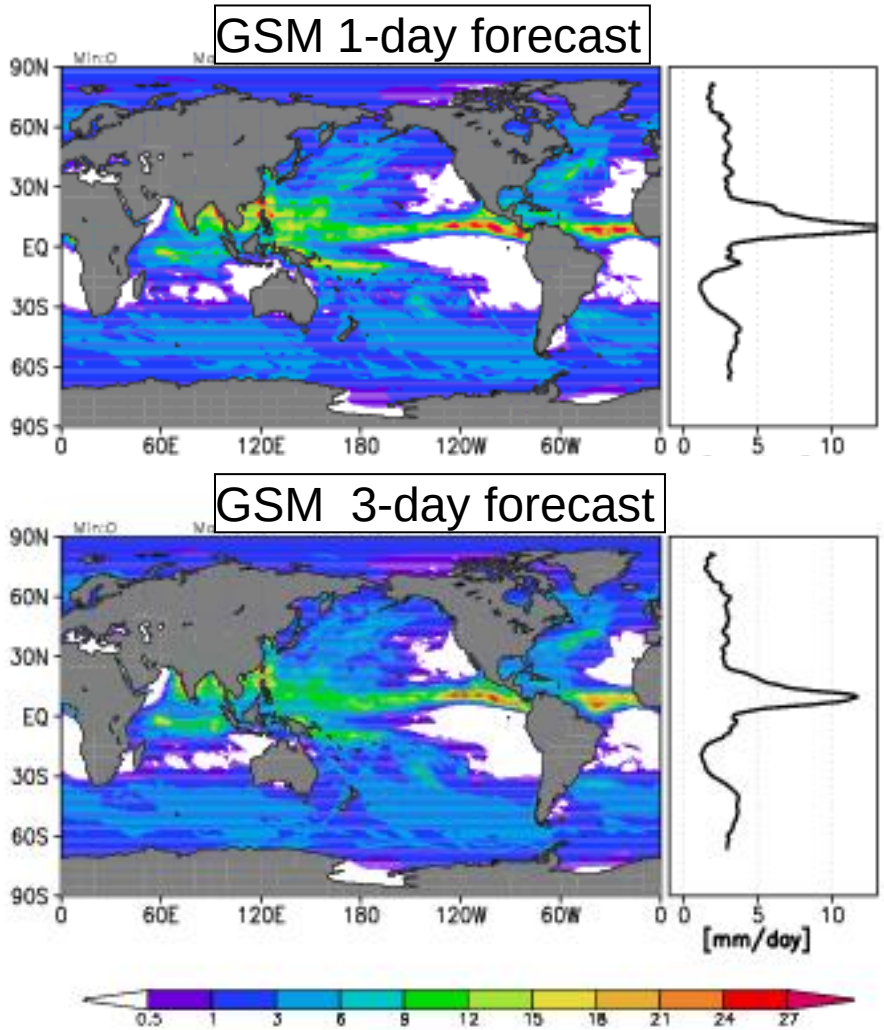
forecast−AMSR-E

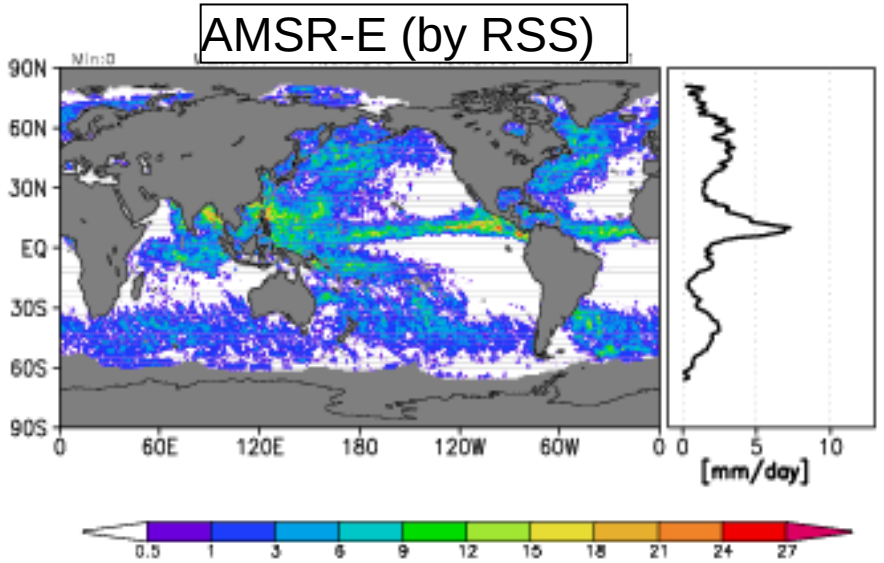


Property of the model

- Wet bias between ITCZ and SPCZ
- Dry bias in Philippine Sea
- The biases have expanded as the forecast advanced.

Verification of model : Rain



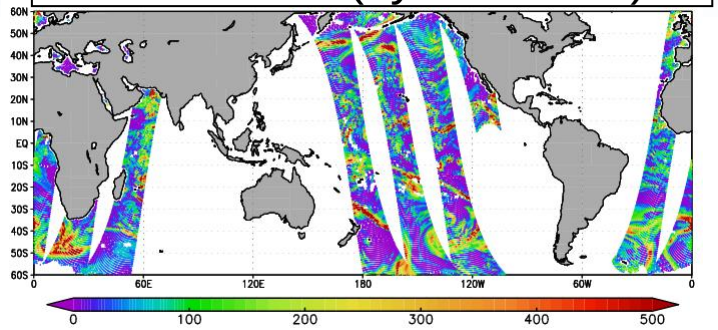


(Aug 2007, monthly ave)

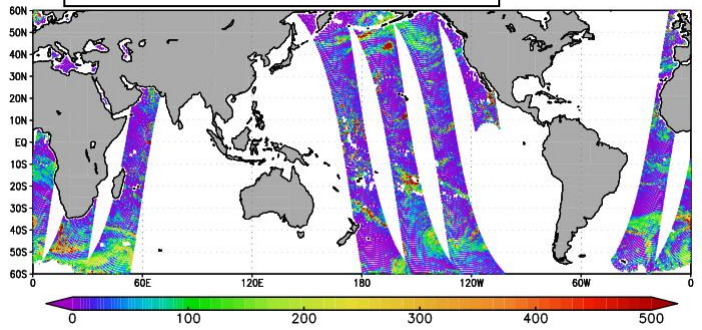
- Excessive rain of the model at the beginning of the forecast and deep convection area
- It is possible to verify the rain forecast around the world
  - Rain radar area is limited

Verification of model : CLW

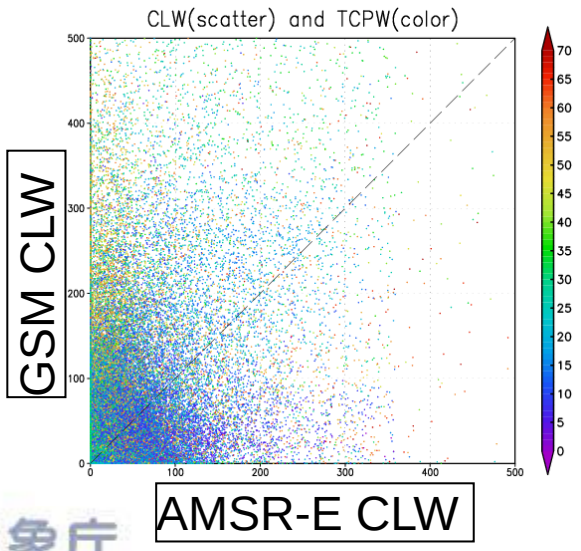
AMSR-E CLW (by Kazumori)



GSM CLW



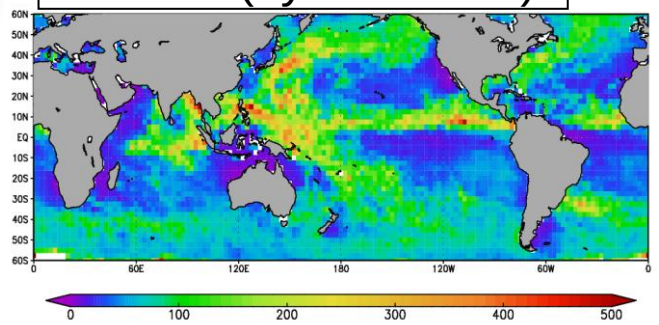
(00Z 01 Sep 2009)



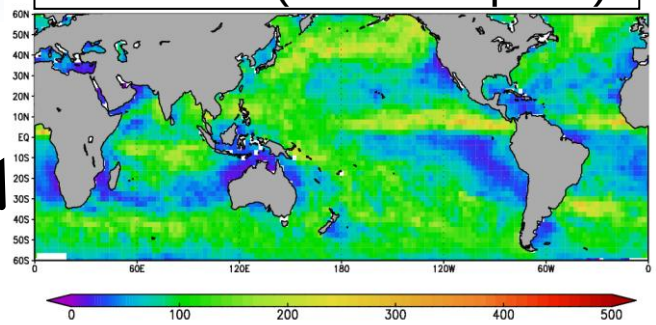
- It is very difficult to verify quantitatively
  - No truth data
    - MODIS? CloudSat?
  - different time scale, different spatial scale

Monthly average of CLW

AMSR-E (by Kazumori)

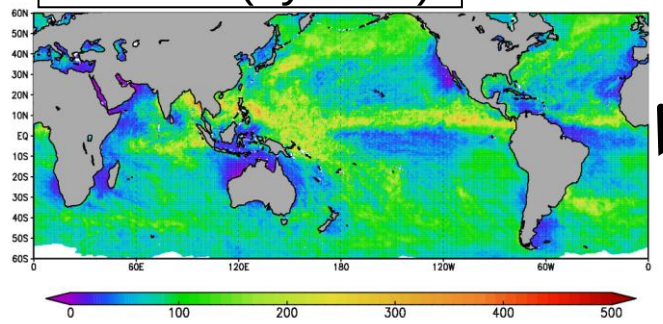


GSM CLW (AMSR-E point)

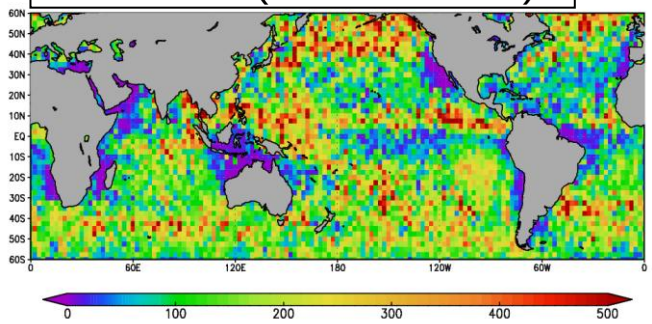


Similar?

AMSR-E (by RSS)



CloudSat (2B-CWC-RVOD)

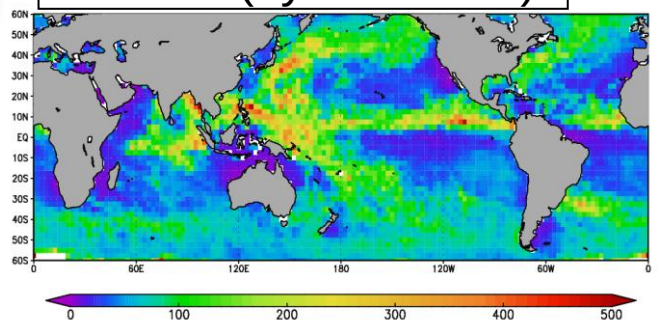


(Sep 2009)

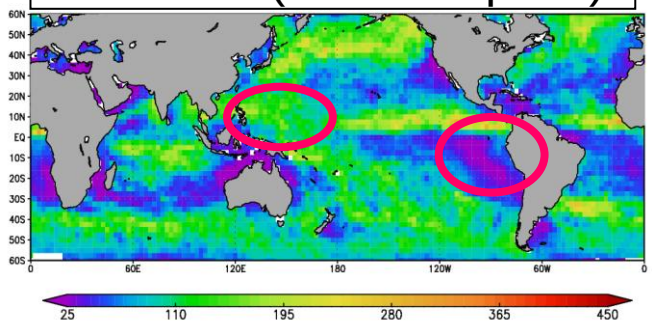
- It is difficult to compare ...

Monthly average of CLW (different color scale)

AMSR-E (by Kazumori)



GSM CLW (AMSR-E point)



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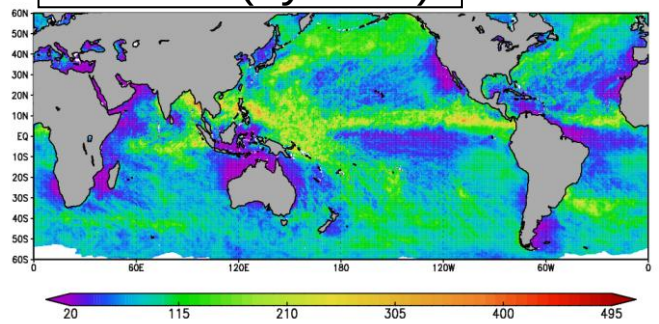

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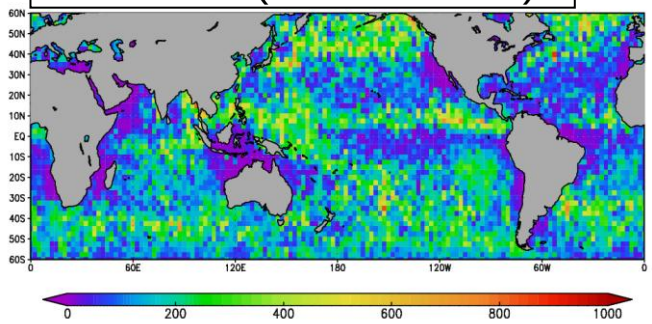

(Sep 2009)

- GSM lacks CLW in Philippine Sea and off the coast of Peru.

Summary

- About JMA NWP Models
  - MSM : retrieved Rain and TCPW
  - GSM : radiance data over the clear sky ocean
- Impacts of AMSR-E in JMA's Models
  - It improves the rain forecast
- Verification of the model with AMSR-E
  - Issues were found with TCPW, Rain, and CLW

Acknowledgements

- Japan Aerospace Exploration Agency
- NASA CloudSat project
- Remote Sensing Systems